

**U. S. FISH AND WILDLIFE SERVICE  
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Nysius wekiuicola*

COMMON NAME: Wekiu bug

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: September 2005

**STATUS/ACTION:**

☐ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 29, 2003

☒ Petitioned - Date petition received: May 11, 2004

☐ 90-day positive - FR date:

☒ 12-month warranted but precluded - FR date: May 11, 2005

☒ Did the petition request a reclassification of a listed species?

**FOR PETITIONED CANDIDATE SPECIES:**

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (<http://endangered.fws.gov>).

☒ Listing priority change

Former LP: 2

New LP: 8

Date when the species first became a Candidate (as currently defined): October 25, 1999

\_\_\_\_ Candidate removal: Former LP: \_\_\_\_\_

\_\_\_\_ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

\_\_\_\_ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

\_\_\_\_ F – Range is no longer a U.S. territory.

\_\_\_\_ I – Insufficient information exists on biological vulnerability and threats to support listing.

\_\_\_\_ M – Taxon mistakenly included in past notice of review.

\_\_\_\_ N – Taxon does not meet the Act's definition of "species."

\_\_\_\_ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Insects; Family Lygaeidae (seed bug)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Hawaii

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Hawaii

LEAD REGION CONTACT: Paul Phifer (503) 872-2823, paul\_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish & Wildlife Office, Stephen E. Miller (808) 792-9400, stephan\_e\_miller@fws.gov

#### LAND OWNERSHIP

This species occurs only on the upper Mauna Kea summit, which is owned by the State of Hawaii and administered by the Office of Mauna Kea Management.

#### BIOLOGICAL INFORMATION:

Species Description: The adult Wekiu bug is approximately 3.4 to 4.9 millimeters (mm) (0.13 to 0.19 inches (in)) long and 1.0 to 1.8 mm (0.04 to 0.07 in) wide. The head is black, with pale reddish-brown median bars from the base of head to just short of the anterior eye margins. The pronotum is black and grayish-brown, the abdomen is black with pale lateral margins, and the legs are black (Ashlock and Gagne 1983).

Taxonomy: The seed bug family Lygaeidae is in the order Hemiptera (true bugs). The family is a variable group usually recognized by four-segmented antennae, a four-segmented beak, small eyes (ocelli), and four or five simple veins in the membrane of the wings (hemelytra) (Borror *et*

*al.* 1992). Within the family, individual length varies from 2 to 18 mm (0.8 to 0.7 in), and many species are brightly marked with bands of black, white, or red. Most Lygaeid species feed on seeds, although the family does have a few predatory species. The order Hemiptera contains many predator species, including entire families of predators, (*e.g.*, Reduviidae) (Borror *et al.* 1992).

Of the 106 species of *Nysius* worldwide, 26 are endemic to Hawaii. Most of these Hawaiian *Nysius* feed on the seed heads of native plants (Polhemus 1998) and are characterized by conspicuous pubescence and erect setae (hairs) on the greater part of the dorsal surfaces; very narrow heads (at the eyes it is less than the narrowest breadth of the pronotum (the plate covering the thorax); and concave hind margins of the metapleura (side of thorax) with the postero-lateral angle rounded off (Zimmerman 1948).

*Nysius wekiuicola* was described as a distinct taxon by Ashlock and Gagne in 1983 and the most recent and recognized taxonomic write up. Wekiu is a Hawaiian word meaning “tip, top, topmost, summit” and was selected as the common name in reference to the insect’s habitat (Ashlock and Gagne 1983). The bug has extremely small wings (micropterous), has by far the longest, thinnest appendages in relation to body length of any Lygaeid in the world, and the most elongate head as well.

Habitat: The island of Hawaii today consists of five volcanic mountains. All are very young and three have been active in recent history (MacDonald *et al.* 1983). Mauna Kea is the highest of these volcanoes, rising 4,206 meters (m) (13,796 feet (ft)) above sea level. The surface lavas of this volcano are all younger than middle Pleistocene, and it has probably not been active during the last 2,000 years. During the Pleistocene epoch an ice cap existed on the summit of Mauna Kea, with at least four distinct glacial episodes during the last 300,000 years (Porter 1979). The most recent glacial event (the Mānāpa ice cap) disappeared from Mauna Kea about 9,000 years ago, but permanent ice still exists in the cinder of the summit cones just a few feet below the surface (Woodcock 1974).

Currently on Mauna Kea, an alpine lava community is present above 3,000 m (9,843 ft). This community is sparsely vegetated with growths of foliose lichens and the moss, *Racomitrium lanuginosum* (Gagne and Cuddihy 1990). Prior to the 1980s, due to an apparent lack of vegetation, it was popularly believed the Mauna Kea summit was a lifeless alpine desert (Waldrop 1981). However, in 1979 with the discovery of the Wekiu bug, and subsequently into the early 1980s, an entire aeolian community of arthropods was discovered at the summit (Mull and Mull 1980; Papp 1981; Gagne and Howarth 1982). Aeolian ecosystems are characterized by a near lack of natural producers; a windborne supply of nutrient material; a few plants such as algae, mosses, and lichens; and a community of mostly arthropod predators and scavengers evolved to feed on the windborne food supply. On Mauna Kea’s summit, the major faunal components include a flightless moth whose caterpillars feed on the lichens, a *Lycosa* wolf spider that preys on other insects, a centipede that preys on moribund insects blown to the summit, and the unique, flightless Wekiu bug (Howarth and Stone 1982).

At least six major habitat types can be recognized within this alpine ecosystem, and not all are suitable for each of the aeolian species (Howarth and Stone 1982): 1) snow patches provide moisture and help retain food for the summit arthropods, but are not directly utilized by any of the species; 2) tephra ridges and slopes on cinder cones are important habitat for the spider, the Wekiu bug, and smaller arthropods such as springtails; 3) loose, steep tephra slopes with smaller cinders are not suitable habitat for the Wekiu bug; 4) lava flows with large outcrops of andesitic (iron-poor gray lava) rock are the primary habitat for the moth, the spider, and the centipede, but the Wekiu bug is rare in this habitat due to the lack of suitable microclimate; 5) talus slopes and fractured rock outcrops are typically smaller areas that occur within areas of andesitic lava flows and are suitable habitat for the Wekiu bug; and 6) compacted ash, silt, and mud along roadsides and in depressions. Because the interstitial voids among the cinders are filled, the aeolian arthropods cannot utilize this habitat (Howarth and Stone 1982).

The Wekiu bug is a unique component of the high elevation aeolian ecosystem on Mauna Kea (4,206 m (13,796 ft above sea level)). Along with its close relative on Mauna Loa (4,169 m (13,679 ft)), the Wekiu bug differs from all other *Nysius* species in its predatory habits and unusual physical characteristics and high elevation habitat (Polhemus 1998). Wekiu bugs are most often found under rocks and cinders. They are diurnally active and feed on moribund and dead insects that blow up from lower elevations. The presence of high altitude arthropods on Mauna Kea has been known since the 1920s (Bryan 1923, 1926; Swezey and Williams 1932; Wentworth *et al.* 1935; Usinger 1936; Gagne 1971), but it wasn't until 1980 that the Wekiu bug and other arthropods were identified as being resident predator-scavengers. In field conditions, the Wekiu bug has been observed feeding upon adult lady beetles, upon recently dead adult syrphid flies, and even dead birds. The Wekiu bug has not been observed feeding upon other resident aeolian arthropods (Ashlock and Gagne 1983; Howarth 1997a). Larval and adult Wekiu bugs can remain active during winter months, and exhibit activity at ambient air temperatures of minus 7 degrees Celsius (19 degrees Fahrenheit) (Frank Howarth, Bishop Museum, pers. comm. 1998). The cold of the annual snow fall on Mauna Kea may assist the Wekiu bug by immobilizing and preserving prey that are carried by winds up to the upper elevations and summit of Mauna Kea. Although difficult to establish, it is widely believed the Wekiu bug has some obligatory association with snow and/or permafrost, the former for food, and the latter especially for year-around moisture. This would at least partly explain its restriction to higher elevations on Mauna Kea. Wekiu bugs are fairly susceptible to dehydration, which may be related to extreme swelling of the abdomen (physogastricity) after feeding (Ashlock and Gagne 1983). Wekiu bugs will emerge from beneath the 7.6 to 25 centimeter (3 to 10 in) diameter tephra (volcanic pyroclastic rock) to feed and mate when the sun has warmed the rock surfaces, particularly at the margins of snow fields. They may prefer the narrow melting, outer perimeter of snowfields where they can take advantage of any frozen insects which drop from the receding snowfield perimeter (Howarth 1997a). The onset of a shadow or the sunset will result in a quick retreat of the bugs into the tephra. Numerous surveys show that the distribution and biology of these bugs is strongly linked with the tephra cinder cones present on Mauna Kea, especially in the summit area (Ashlock and Gagne 1983); tephra habitats have yielded the highest capture rates of Wekiu bugs. The tephra may facilitate vertical movement through the interstitial spaces according to day and night or seasonal temperatures. The bugs may also follow shifting

snowfield edges by means of the spaces between the tephra (Howarth 1997b).

Historic and Current Range Distribution: The Wekiu bug was first discovered in 1979 by F.G. Howarth, S.L. Montgomery, and W.P. Mull on Puu Wekiu, the summit cinder cone of Mauna Kea on the island of Hawaii (Ashlock and Gagne 1983). Currently, the Wekiu bug is known to be limited to Mauna Kea on various cinder cones above approximately 3,474 m (11,400 ft).

#### THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range. Due to atmospheric and weather conditions, the University of Hawaii has developed the summit area as the Mauna Kea Science Reserve for astronomical study (RCUH 1983). There are 4,532 hectares (ha) (11,200 acres (ac)) in the Mauna Kea Science Reserve. The Reserve's lower boundary is 3,566 m (11,700 ft) to 3,688 m (12,100 ft) elevation. Above 3,658 m (12,000 ft), there are approximately 1,538 ha (3,800 ac) contained within the protected, State-owned natural area reserves (RCUH 1983). The lowest elevation the Wekiu bug has been found was near the Very Long Baseline Array observatory at 3,572m (11,715 ft) (NASA 2005).

To date, 14 telescopes (including the removal of one in 1994) and several buildings and associated structures have been constructed on the summit. The 1985 Summit Management Plan authorizes a total of 13 telescopes (State Auditor 1998). Resultant impacts have included road construction, parking areas, tourist facilities, temporary storage areas, substrate removal, and oil spills, and daily traffic to the summit with the concomitant human dispersal of trash and debris. The preferred habitat of the Wekiu bug, tephra cinders, are easily crushed to dust-sized particles, and vehicular traffic can quickly result in permanent changes from rocky tephra habitat to compacted silt and mud. Furthermore, the silt and mud has the potential to degrade nearby tephra habitat by filling the interstitial spaces between cinders that are used by this bug and other arthropods (Ashlock and Gagne 1983).

The Institute for Astronomy receives and entertains new inquiries/proposals for telescope construction on an on-going basis (State Auditor 1998). The summit area of Mauna Kea is one of the most desirable locations worldwide for astronomical observation. In addition to the possibility of new facility construction, many of the existing facilities and structures are nearly 25 years old and will probably soon require rebuilding and updating (State Auditor 1998). This would likely include new construction and expansion. All new construction activities require environmental impact analyses through the National Environmental Policy Act. A Wekiu bug monitoring plan is in place and being implemented (NASA 2005). The Wekiu bug mitigation plan requires habitat to be restored in areas damaged by on-site Outrigger Telescope construction with restored areas totaling at least three times the total area damaged by new construction (NASA 2005). In addition, the Office of Mauna Kea Management (OMKM) and the Pacific Islands Office of the Fish and Wildlife Service (PIFWO) are in discussions regarding a candidate conservation agreement that will include conservation activities to reduce these threats from construction and other habitat-altering

activities on the summit of Mauna Kea.

B. Over-utilization for commercial, recreational, scientific, or educational purposes.

We are unaware of any current threats to this species resulting from over-utilization.

C. Disease or predation.

There are no data or information on diseases that may affect the Wekiu bug. The Wekiu bug and other Mauna Kea arthropods rely on wind-transported (aeolian) insects for food. The amounts and type of prey upon which they depend may be affected by intentional or accidental introductions of alien arthropods and parasites at lower elevations (F. Howarth, pers. comm. 1998). Currently, at least one introduced species of linyphiid (small sheetweb) spider has become established on the summit and may compete with the Wekiu bug for food resources and may also prey on the Wekiu bug (Howarth and Stone 1982).

D. The inadequacy of existing regulatory mechanisms.

The summit area of Mauna Kea is within the State conservation district and construction in the area requires a permit from the State Department of Land and Natural Resources (DLNR) (State Auditor 1998). Prior to development of the Mauna Kea Science Reserve, a development plan for the summit area was written that addressed the sensitivity of the Wekiu bug and its habitat. Despite the fact that important Wekiu bug habitat was identified as sensitive in the 1983 plan and was to be avoided in the development of the facilities, a lack of communication and monitoring of construction activities at the summit during construction of the Subaru telescope facility resulted in the loss of most Wekiu bug habitat in Puu Hau Oki (Fred Stone, University of Hawaii, *in litt.* 1996; State Auditor 1998).

A 1997 report on the State of Hawaii's audit of the management of Mauna Kea and the Mauna Kea Science Reserve states, "management of Mauna Kea fails to adequately ensure protection of our natural resources" (State Auditor 1998). In addition, unapproved construction activities on the summit area, unauthorized cinder cone and crater "reshaping" activities, and large spills of motor oil have been reported (F. Stone *in litt.* 1996; State Auditor 1998). In response to the State Auditor's 1998 report, the Institute for Astronomy, the University of Hawaii, and DLNR have agreed to better manage the Mauna Kea Science Reserve and its natural resources. The University of Hawaii's Institute for Astronomy has developed a Mauna Kea Science Reserve master plan (Plan) and is funding a series of surveys to determine how the impact of future development might impact the flora and fauna (particularly the Wekiu bug) of the summit area (University of Hawaii 1999). This Plan lists 12 existing observatories; five of these are proposed for redevelopment that may include an increase in size and area, and two more are listed as having new additions. The Plan also identifies five new observatories that may be developed at some future time (University of Hawaii 1999). Development of interferometers on Mauna Kea may continue under the current management plan since they do not count as "telescopes". Interferometers are specialized antennae for observing astronomical occurrences, and the resulting structures can impact significant surface areas (State Auditor 1998).

Prior to June 2000, neither the University of Hawaii (UH) nor the DLNR had a regulatory mechanism or plan that took into consideration the ecological needs of the Wekiu bug or other Mauna Kea flora and fauna. In June 2000, the Board of Regents of the University of Hawaii approved a new Master Plan for the Mauna Kea Science Reserve, discussed above. The Plan created the Office of Mauna Kea Management to manage the Science Reserve. In addition to OMKM, the plan directed the Chancellor of UH Hilo to establish a community based advisory board, Mauna Kea Management Board, and a Native Hawaiian advisory board, Kahu Ku Mauna Council. The Mauna Kea Management Board and Kahu Ku Mauna Council advise the Chancellor and OMKM on matters relating to the University's leased lands on Mauna Kea. They also recommend approval or denial of projects proposed for development on Mauna Kea. Working together, OMKM, Mauna Kea Management Board, and Kahu Ku Mauna Council are responsible for ensuring the protection of Mauna Kea's natural and cultural resources, as well as reviewing all developments proposed on University-leased lands on Mauna Kea.

The Master Plan also directs OMKM to review and comment on all proposed development on the summit of Mauna Kea and to develop management actions that will protect and enhance the natural and environmental resources of Mauna Kea. All proposed development must undergo a stringent review. Impacts on the natural and cultural resources that are deemed to have significant adverse effects must be addressed and the developer must revise its design such that it will eliminate or minimize the impacts. If these impacts are not removed or minimized, OMKM will recommend denial of the project. To assist OMKM with the development of plans to manage natural and cultural resources, the Mauna Kea Management Board has established several committees, including an Environment Committee. This committee, composed of scientists from the Hawaii island community, identified programs and activities to help restore, preserve protect and enhance the natural resources of Mauna Kea. These plans and actions include, or will include the Wekiu bug and all other native species and habitats within the Science Reserve.

Shortly after OMKM was established, a ranger corps was established. Rangers patrol the Science Reserve monitoring observatory and visitor activities. Their role and responsibilities include educating people about the environmental and cultural significance of Mauna Kea; monitoring human activity by keeping people off and away from sensitive cultural and natural resources, including Wekiu bug habitat; monitoring observatory activity such as construction and maintenance work ensuring those activities do not adversely impact the surrounding areas; accompanying film crews to ensure compliance with permit conditions such as not filming off road or off trail or in sensitive natural and cultural resource areas; and monitoring commercial operators for compliance with their permits and ensuring customers do not venture into sensitive natural and cultural resource areas.

Currently, the University of Hawaii is working closely and cooperatively with the Natural Area Reserves system (NARs) of DLNR. The Mauna Kea Ice Age NAR occupies a significant portion of the summit area of Mauna Kea and includes Wekiu bug habitat. Mauna Kea rangers monitor the NAR for similar activities described above. OMKM is also

working with the DLNR on developing rules and regulations relating to public access to Mauna Kea. The OMKM has been in existence just under four years. During this short period of time, it has initiated programs to address the concerns for the Wekiu bug. Because implementation of the Plan is still in the early stages, assessment of the adequacy of the Plan's ability to protect the Wekiu bug cannot yet be fully determined. However, it should be noted that prior to the establishment of OMKM there were no safeguards in place to protect the natural or cultural resources on the mountain.

E. Other natural or manmade factors affecting its continued existence.

Shifts in global climate (toward warmer winters with less snowfall on the Mauna Kea summit) may potentially threaten the Mauna Kea arthropods, including the Wekiu bug. The summit area has been warmer and has had less snowfall since 1982 (Howarth 1997a). The capture rates for Wekiu bug in a 1997 study were significantly lower than the rates obtained in the 1982 study (Howarth 1997c). It is possible that as the summit area becomes warmer over time, alien predators and parasites could more easily become established in the summit area. These alien species could have direct and indirect effects on the Wekiu bug. In addition, if available habitat is seriously reduced by summit development, the Wekiu bug will likely be less capable of responding and surviving during climatic changes (F. Howarth, pers. comm. 1998). There are no known conservation activities to address these threats for this species.

#### CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Several members of the local community and the scientific community are interested in and have taken active steps to help protect the arthropod fauna of the Mauna Kea summit. In 1982, two biological surveys above the 3,963 m (13,000 ft) level were completed as part of the environmental impact studies for planned construction of astronomy facilities. A second, more inclusive environmental impact study was conducted in 1985, which developed into the first Mauna Kea Master Plan. In 1997 and 1998, the Bishop Museum was contracted by the Institute for Astronomy to conduct research necessary for development of an arthropod conservation plan for the Mauna Kea summit. The Bishop Museum's goal was to identify the high priority habitat areas needing protection and also to delineate the extent of the Wekiu bug's range (Brenner *et al.* 1997a, b).

The adoption of the Mauna Kea Science Reserve Master Plan (Plan) by the Board of Regents of the University of Hawaii in June 2000 effectively changed the management of all activities on Mauna Kea. The Plan established management guidelines for the next 20 years. The process reflects the community's concerns over the use of Mauna Kea, including respect for Hawaiian cultural beliefs, protection of environmentally sensitive habitat, recreational use of the mountain, as well as astronomy research. The Plan places responsibility for future development and management of natural and cultural resources with the UH Hilo in the Office of Mauna Kea Management and Mauna Kea Management Board.

In June 2001, the State contracted a Smithsonian Institution researcher to do a survey of Puu Hau Kea within the NAR within the summit area. The survey revealed surprisingly high numbers of



the bug within this habitat area (Polhemus 2001). During April, May and September of 2002, additional surveys for the Wekiu bug were conducted by the Bishop Museum as contracted by the State for the purpose of further delineating the species' habitat range (Englund *et al.* 2002). Beginning in February 2002, the Keck Observatory contracted an independent researcher (Pacific Analytics, L.L.C.) to conduct quarterly surveys and baseline monitoring for the Wekiu bug in and around the Puu Hau Oki crater and those areas adjacent to the observatory and to evaluate options for habitat mitigation and restoration in areas disturbed by future development activities at the Keck Observatory (Brenner 2002-2003). We have been receiving these quarterly reports from the researcher.

On June 17, 2004, we received an independent review of the status of the Wekiu bug on Mauna Kea (Wekiu Bug Scientific Data Review Committee 2004). The review was done at the request of the Office of Mauna Kea Management, and the review committee was comprised of scientists who are experts in insect ecology and biology; life in extreme environments such as the summit of Mauna Kea; and data collection and analysis. These scientists are affiliated with Hawaii Community College, the University of Hawaii, the State Division of Forestry and Wildlife, and the U.S. Geological Survey's Biological Resources Discipline. Others who attended but did not have any formal role in the decision-making process were from Office of Mauna Kea Management, KAHEA, the University of Hawaii's Institute of Astronomy, and the U.S. Fish and Wildlife Service. The committee reviewed the scientific merits of the available information on the Wekiu bug and the extent to which this information supports the current candidacy of the species, including the five threats categories, and the committee agreed the information supports our conclusion that the Wekiu bug is a candidate for listing. Additional surveys will be done during the coming year and habitat condition data will be collected. The University of Hawaii and the Mauna Kea Observatory is embarking on a four year life history and genetics study of the Wekiu bug.

**SUMMARY OF THREATS:** The Wekiu bug is primarily threatened by loss of habitat due to development of astronomy facilities. For new construction activities, the Wekiu bug mitigation plan requires habitat to be restored in areas damaged by on-site Outrigger Telescope construction with restored areas totaling at least three times the total area damaged by new construction. Currently, the University of Hawaii is working closely and cooperatively with the NARs of DLNR. Rangers monitor the NAR for similar activities described above. Office of Mauna Kea Management is also working with the DLNR on developing rules and regulations relating to public access to Mauna Kea. In addition, PIFWO and OMKM are in discussions regarding a candidate conservation agreement that will include conservation activities to reduce these threats.

**SUMMARY OF REASONS FOR ADDITION, REMOVAL OR LISTING PRIORITY CHANGE:**

The LPN for this species is being changed from a 2 to an 8 because the magnitude of the threats is no longer considered to be high since the Wekiu bug presence has recently been confirmed in several more summit areas that are not undergoing development. The threats listed above are not occurring throughout the range of the Wekiu bug.

LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
<b>Moderate To Low</b>	<b>Imminent</b>	Monotypic genus	7
		<b>Species</b>	<b>8*</b>
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

*Magnitude:*

The Wekiu bug is primarily threatened by habitat loss due to development of astronomy facilities on the summit of Mauna Kea. However, there are several cinder cones within the Mauna Kea Science Reserve, as well as two other cinder cones located in the NAR, where the Wekiu bug occurs that are not currently undergoing development nor is development planned. The threats, though ongoing, do not occur across the entire range of the Wekiu bug.

*Imminence:*

The immediacy of the threats is imminent in some part of the Weiku bug's range because ongoing development is occurring in the Keck Observatory Outrigger telescope project area. This development will establish six new interferometry telescopes around the existing Keck facility. A mitigation plan is in place that will require a 3:1 replacement of damaged habitat. However, the effectiveness of this mitigation is unknown.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, we are in discussions with the Office of Mauna Kea Management regarding development of a candidate conservation agreement. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor

the status of *Nysius weikiuicola* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

#### DESCRIPTION OF MONITORING

We conducted literature searches for recent articles on this species and contacted relevant species experts, State officials with the Department of Land and Natural Resources, and the University of Hawaii and Bishop Museum researchers, and the Office of Mauna Kea Management regarding the current status of this species. This level of monitoring is appropriate to update the status of the species. Information contained in this assessment form was verified by species experts and new information incorporated. This species is not listed in the Hawaii Biodiversity and Mapping Program (Hawaii Biodiversity and Mapping Program database 2004) or in the International Union for Conservation of Nature and Natural Resources Red Data List database (International Union for Conservation of Nature and Natural Resources database 2004).

#### List of Experts Contacted:

Name	Date	Place of Employment
Neal Evenhuis	July 12, 2005	Bishop Museum
Frank Howarth	July 12, 2005	Bishop Museum
David Preston	July 12, 2005	Bishop Museum
Ronald Englund	July 12, 2005	Bishop Museum
Dan Polhemus	July 12, 2005	Hawaii Division of Aquatic Resources
Betsy Gagne	July 12, 2005	Hawaii Dept of Land and Natural Resources
Dan Rubinoff	July 12, 2005	University of Hawaii
Sheila Conant	July 12, 2005	University of Hawaii
Stephanie Nagata	July 12, 2005	Office of Mauna Kea Management

#### List of Databases Searched:

Name	Date
Hawaii Biodiversity and Mapping Program	2004
International Union for Conservation of Nature and Natural Resources	2004

#### COORDINATION WITH STATES

In October 2004 we provided the Division of Forestry and Wildlife Administrator, Paul Conry, with copies of our most recent candidate assessment forms for his review and comment. In addition, copies of the candidate forms were sent to Betsy Gagne, Executive Secretary for the Hawaii Natural Area Reserves System Commission. Ms. Gagne reviewed the information for this species and provided no additional information or corrections (B. Gagne, pers. comm. 2005).

#### LITERATURE CITED

Ashlock, P.D. and W.C. Gagne. 1983. A remarkable new micropterous *Nysius* species from the aeolian zone of Mauna Kea, Hawaii Island (Hemiptera: Heteroptera: Lygaeidae).

International Journal of Entomology 25(1): 47-55.

Auditor, State of Hawaii. (Prepared by Marion H. Higa, State Auditor). February 1998. Audit of the management of Mauna Kea and the Mauna Kea Science Reserve (Report No. 98-6). pp. 1-54.

Borror, D.J., Triplehorn, C.A., & Johnson, N.F. 1992. An introduction to the study of insects. Harcourt Brace College Publishers. Fort Worth, TX. p. 304.

Brenner, G. J., F. G. Howarth, D. J. Preston, and P. T. Oboyski. 1997a. Preliminary report on the Wekiu bug activity determined by pitfall trapping within selected areas of the Mauna Kea Science Reserve during August 1997.

Brenner, G. J., F. G. Howarth, D. J. Preston, and P. T. Oboyski. 1997b. Preliminary report of work on an arthropod assessment within selected areas of the Mauna Kea Science Reserve Part 2, Wekiu bug activity determined by pitfall trapping within selected areas of the Mauna Kea Science Reserve during 1997.

Brenner, G. J. 2002-2003. Wekiu bug baseline monitoring quarterly reports to the Outrigger Telescopes Project, W. M. Keck Observatory, Kamuela, Hawaii.

Bryan, E.H. 1923. Insects from the summit of Mauna Kea. Proc. Hawaii. Entomol. Soc. 5: 287-88.

Bryan, E.H. 1926. Additional notes on the insects occurring on Mauna Kea and Mauna Loa. Proc. Hawaii. Entomol. Soc. 6: 280-282.

Englund, R. A., D. A. Polhemus, F. G. Howarth, and S. L. Montgomery. 2002. Range, habitat, and ecology of the Wekiu bug (*Nysius wekiuicola*), a rare insect species unique to Mauna Kea, Hawaii Island.

Gagne, W.C. 1971. Note and exhibitions: *Psylla uncatoides* (Ferris & Klyver). Proc. Hawaii. Entomol. Soc. 21(1): 25.

Gagne, W.C. and L.W. Cuddihy. 1990. Vegetation: in Wagner, W.L., D.R. Herbst, and S.H. Sohmer (Eds.), Manual of the flowering plants of Hawaii. University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Mus. Spec. Publ. 83: 45-114.

Gagne, W.C. and F.G. Howarth. 1982. On Mauna Kea "desert" entomologists discover new life. Ka Elele, Bishop Museum Newslett. 9(2): 1,6.

Howarth, F.G. 1997a. Arthropod assessment proposal. (submitted to IfA).

Howarth, F.G. 1997b. Arthropod assessment preliminary report. (submitted to IfA).

- Howarth, F.G. 1997c. Arthropod assessment habitat survey report. (submitted to IfA).
- Howarth, F.G. and F.D. Stone. 1982. An assessment of the arthropod fauna and aeolian ecosystem near the summit of Mauna Kea, Hawaii. Report submitted to Group 70, Honolulu, Hawaii.
- KAHEA: The Hawaiian-Environmental Alliance. 2003. Petition to list the Wekiu bug (*Nysius wekiuicola*) as an endangered species with critical habitat designation. May 22, 2003. 16 pp.
- MacDonald, G.A., A.T. Abbott, and F.L. Peterson. 1983. Volcanoes in the sea. University of Hawaii Press. 517 pp.
- Mull, M.E. and W.P. Mull. 1980. Perspective: the marvelous mountain. Hawaii Tribune-Herald. Sunday, Jan. 27, 1980; Sect. B5.
- National Aeronautics and Space Administration. 2005. Final Environmental Impact Statement for the Outrigger Telescopes Project. Vol 1 & II. Universe Division Science Mission Directorate, Washington D.C.
- Papp, R.P. 1981. High altitude aeolian ecosystems in the Hawaiian Islands. Proc. 3rd Conf. Nat. Sci. Hawaii Volcanoes National Cooperative National Park Resources Studies Unit, University of Hawaii, Manoa. Pp 259-264.
- Polhemus, D.A. 1998. *Nysius aa* (Heteroptera: Lygaeidae), a new species of micropterous Wekiu bug from the summit of Mauna Loa Volcano, Hawaii. Proc. Entomol. Soc. Wash. 100(1): 25-31.
- Polhemus, D.A. 2001. A preliminary survey of Wekiu bug populations at Puu Hau Kea, in the Mauna Kea Ice Age Natural Area Reserve, Hawaii Island, Hawaii.
- Porter, S.C. 1979. Hawaiian glacial ages. Quaternary Research 12:161-187.
- Research Corporation of the University of Hawaii. 1983. Mauna Kea Science Reserve Complex Development Plan.
- Stone, F. D. 1996. Investigation of the destruction of Wekiu bug habitat on Mauna Kea due to construction activities related to the Japanese National Large Telescope (Subaru) and the Gemini Telescope (letter to IFA).
- Swezey, O.H. and F.X. Williams. 1932. Insects from the summit of Mauna Kea. Proc. Hawaii. Entomol. Soc. 8: 191-192.

- University of Hawaii. 1999. Mauna Kea Science Reserve Master Plan. Environmental Impact Statement. Volumes 1 and 2. University of Hawaii, December 1999.
- Usinger, R.L. 1936. The genus *Geocoris* in the Hawaiian Islands (Hemiptera, Lygaeidae). Proc. Hawaii. Entomol. Soc. 9: 214-15.
- Waldrop, M.M. 1981. Research news. Mauna Kea (I): halfway to space. Science 214:1010-1013.
- Wekiū Bug Scientific Data Review Committee, 2004). Memo transmitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office on June 17, 2004.
- Wentworth, C.K., J.W. Coulter & C.E. Hartt. 1935. The Mauna Kea Expedition of 1935: Hawaii Academy of Science. 95p. Manuscript located at B.P. Bishop Museum Library.
- Woodcock, A.H. 1976. Permafrost and climatology of a Hawaii volcano crater. Arctic and Alpine Research 6: 49-62.
- Zimmerman, E.C. 1948. Insects of Hawaii: Volume 3-Heteroptera. University of Hawaii Press. Honolulu, HI. p. 93.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: **Acting** David W. Winkler  
Regional Director, Fish and Wildlife Service

11/18/05  
Date

Marshall P. Jones Jr.

Concur: \_\_\_\_\_  
Director, Fish and Wildlife Service

August 23, 2006  
Date

Do not concur: \_\_\_\_\_  
Director, Fish and Wildlife Service

\_\_\_\_\_  
Date

Date of annual review: 10/7/05

Conducted by: Lorena Wada, Pacific Islands FWO

Comments:

PIFWO Review

Reviewed by: Christa Russell  
Acting Assistant Field Supervisor, Endangered Species

Date: 10/11/05

Patrick Leonard  
Field Supervisor

Date: 10/11/05